CLAIMS

1. A method of receiving digital information from an input optical signal, comprising:

receiving an optical signal containing digital information, wherein the optical signal comprises an in-phase (I) component, a quadrature (Q) component and a carrier signal; and

phase locking the I component and the Q component.

2. The method of claim 1, wherein the receiving comprises converting the optical signal to an electrical signal, and wherein the phase locking is performed on the electrical signal.

3. The method of claim 2, wherein the converting is accomplished with a photodetector.

4. The method of claim 2, further comprising phase filtering the electrical signal to compensate for dispersion.

5. The method of claim 4, wherein the receiving comprises receiving the optical signal from an optical wave guide, and wherein the phase filtering comprises applying additional dispersion to the electrical signal having a group delay substantially opposite that of the optical wave guide.

6. The method of claim 2, wherein the phase locking comprises:

separating the in-phase component from the quadrature component, wherein each of the in-phase component and the quadrature component includes a Direct Current (DC) portion and a Radio Frequency (RF) portion;

separating the DC portion from the RF portion for each of the in-phase component and the quadrature component, wherein the digital information comprises the RF portion for both the in-phase component and the quadrature component; and

adjusting the DC portion for the in-phase component and the DC portion for the quadrature component so as to be complementary.

7. The method of claim 6, wherein separating the in-phase component from the quadrature component comprises employing an IQ demodulator.

8. The method of claim 6, wherein separating the DC portion from the RF portion for each of the in-phase component and the quadrature component comprises employing a bias-T element for each of the in-phase component and the quadrature component.

9. The method of claim 6, wherein the adjusting comprises:

comparing the DC portion of the in-phase component with the DC portion of the quadrature component to obtain a difference signal; and

zeroing the difference signal to produce a zeroed difference signal.

10. The method of claim 9, wherein separating the in-phase component from the quadrature component comprises separating with an IQ demodulator, and wherein the phase locking further comprises:

generating a reference signal for a local oscillator based on the zeroed difference signal, wherein the local oscillator provides a reference signal to the IQ demodulator.

11. The method of claim 10, wherein the generating comprises generating the reference signal for the local oscillator with a voltage controlled crystal oscillator.

12. The method of claim 11, wherein the comparing is accomplished with a comparator.

13. The method of claim 11, wherein the zeroing is accomplished with an integrator and offset voltage control.

14. The method of claim 11, further comprising adjusting a voltage provided to the voltage controlled crystal oscillator.

15. The method of claim 14, wherein adjusting the voltage comprises combining a voltage signal with the zeroed difference signal to produce an adjusted signal for providing to the voltage controlled crystal oscillator.

16. The method of claim 9, wherein the comparing and zeroing are accomplished via a computer unit.

17. The method of claim 1, wherein the carrier signal comprises a single offset frequency.

18. The method of claim 17, wherein the single offset frequency comprises +30 GHz or –30GHz from a data band center.

19. The method of claim 17, wherein the single offset frequency comprises an integer multiple of half a bit rate for the optical signal.

20. A receiver for receiving digital information from an optical signal, comprising:

an optical receiver for receiving an optical signal, comprising an in-phase (I) component, a quadrature (Q) component and a carrier signal; and

a phase lock for locking the I component and the Q component.

21. The receiver of claim 20, wherein the optical receiver converts the optical signal to an electrical signal, and wherein the phase lock operates on the electrical signal.

22. The receiver of claim 21, wherein the optical receiver comprises a photodetector.

23. The receiver of claim 21, further comprising a phase filter for filtering the electrical signal to compensate for dispersion.

24. The receiver of claim 23, wherein the phase filter compensates for dispersion from an optical wave guide, and wherein the phase filter comprises means for applying additional dispersion to the electrical signal having a group delay substantially opposite that of the optical wave guide.

25. The receiver of claim 21, wherein the phase lock comprises an IQ demodulator for separating the I component from the Q component.

26. The receiver of claim 25, wherein each of the I component and the Q component includes a Direct Current (DC) portion and a Radio Frequency (RF) portion, and wherein the phase lock further comprises a bias T element for each of the I component and the Q component to separate the DC portion from the RF portion.

27. The receiver of claim 26, wherein the phase lock further comprises a local oscillator for providing a reference signal to the IQ demodulator.

28. The receiver of claim 27, wherein the phase lock further comprises a reference signal generator for generating a reference signal for the local oscillator based on the DC portion of the I component and the DC portion of the Q component.

29. The receiver of claim 28, wherein the reference signal generator comprises a voltage controlled crystal oscillator.

30. The receiver of claim 29, wherein the reference signal generator further comprises a comparator for producing a signal representing a difference between the DC portion of the I component and the DC portion of the Q component.

31. The receiver of claim 30, wherein the reference signal generator further comprises an integrator with offset voltage control for zeroing the difference.

32. The receiver of claim 31, wherein the reference signal generator further comprises:

a frequency center control for providing a voltage to adjust a voltage out of the integrator; and

a combiner for combining the voltages from the frequency center control and the integrator.

33. The receiver of claim 29, wherein the reference signal generator further comprises a computing unit programmed to:

compare the DC portion of the I component and the DC portion of the Q component;

zero a difference between DC portion of the I component and the DC portion of the Q component; and

adjust a voltage output to be within a range needed for the voltage controlled crystal oscillator.

34. The receiver of claim 28, wherein the reference signal generator comprises a filter.

35. The receiver of claim 20, wherein the carrier signal comprises a single offset frequency.

36. The receiver of claim 35, wherein the single offset frequency comprises +30 GHz or –30GHz from a data band center.

37. The receiver of claim 35, wherein the single offset frequency comprises an integer multiple of half a bit rate for the optical signal.

38. A receiver for receiving digital information from an optical signal, comprising:

an optical receiver for receiving an optical signal, comprising an in-phase (I) component, a quadrature (Q) component and a carrier signal, and generating an electrical signal representative thereof;

a phase filter for dispersion compensation of the electrical signal;

an IQ demodulator for separating the I component from the Q component, wherein each of the I component and the Q component includes a Direct Current (DC) portion and a Radio Frequency (RF) portion;

a bias-T element for each of the I component and the Q component to separate the DC portion from the RF portion;

a local oscillator for providing a reference signal to the IQ demodulator; and

a reference signal generator for providing a reference signal to the local oscillator based on the DC portion of each of the I component and the Q component.

39. The receiver of claim 38, wherein the optical receiver comprises a photodetector.

40. The receiver of claim 38, wherein the reference signal generator comprises:

a comparator for comparing the DC portion of the I component and the DC portion of the Q component to provide a difference signal;

an integrator with offset control for receiving and zeroing the difference signal; and

a voltage controlled crystal oscillator for providing a reference signal to the local oscillator based on an output signal from the integrator.

41. The receiver of claim 40, wherein the reference signal generator further comprises:

a filter for filtering and providing the difference signal to the integrator;

a frequency center control for providing a voltage to adjust a voltage out of the integrator; and

a combiner for combining the voltage from the integrator with the voltage from the frequency center control to produce a control voltage for the voltage controlled crystal oscillator.

42. The receiver of claim 38, wherein the reference signal generator comprises:

a computing unit for comparing the DC portion of the I component and the DC portion of the Q component and zeroing the difference;

a filter for filtering an output signal from the computing unit; and

a voltage controlled crystal oscillator for providing a reference signal to the local oscillator based on the output signal from the computing unit.

43. Apparatus to compensate for optical signal dispersion from an optical wave guide of known length, comprising a phase filter having a group delay substantially opposite that of the optical wave guide.

44. The apparatus of claim 43, wherein the phase filter comprises a plurality of broadside-coupled microwave strip lines.

45. A method of compensating for dispersion of an optical signal from an optical wave guide of known length, comprising applying additional dispersion having a group delay substantially opposite that of the optical wave guide.

46. The method of claim 45, wherein the applying comprises:

generating an electrical signal representative of the optical signal; and

apply the additional dispersion to the electrical signal.

47. A system for optically transferring information, comprising:

a transmitter for transmitting an optical signal comprising a carrier signal, an in-phase (I) component and a quadrature (Q) component;

an optical wave guide for transferring the optical signal; and

a receiver, comprising:

an optical receiver for receiving the optical signal; and

a phase lock for locking the I component and the Q component.

48. The system of claim 47, wherein the transmitter comprises:

an optical carrier signal generator for generating an optical carrier signal having a first polarization state;

an optical data signal generator for generating an optical data signal separate from the optical carrier signal and having a second polarization state; and

means for matching the first polarization state and the second polarization state.

49. The system of claim 47, wherein the optical carrier signal generator is capable of generating an optical carrier signal with a dominant second order harmonic.

50. The system of claim 47, wherein the optical carrier signal generator is capable of suppressing odd harmonics.

51. The system of claim 47, wherein the optical carrier signal generator comprises a radio frequency (RF) signal generator for generating at least one Radio Frequency (RF) signal.

52. The system of claim 51, wherein the optical carrier signal generator further comprises at least one phase modulator for modulating radiation with the at least one RF signal to produce at least one modulated signal.

53. The system of claim 52, wherein the at least one RF signal comprises a first RF signal and a second RF signal, wherein the at least one phase modulator comprises a first phase modulator and a second phase modulator, and wherein the optical carrier signal generator further comprises a phase shifter for phase shifting a phase modulated signal from one of the first phase modulator and the second phase modulator to produce a phase shifted signal.

54. The system of claim 53, wherein the optical carrier signal generator further comprises a combiner for combining the phase shifted signal with a phase modulated signal from the other of the first phase modulator and the second phase modulator.

55. The system of claim 48, wherein the optical data signal generator comprises at least one electrical data signal generator.

56. The system of claim 55, wherein the optical data signal generator further comprises at least one amplifier for amplifying the at least one electrical data signal to produce an amplified signal.

57. The system of claim 56, wherein the at least one amplifier comprises a modulator driver.

58. The system of claim 56, wherein the optical data signal generator further comprises at least one modulator for modulating radiation with the amplified signal to produce a modulated data signal.

59. The system of claim 58, wherein the at least one modulator modulates the optical carrier signal with the amplified signal to produce the optical data signal.

60. The system of claim 58, wherein the at least one modulator comprises a Mach-Zehnder interferometric modulator.

61. The system of claim 58, wherein the at least one electrical data signal generator comprises a first electrical data signal generator and a second electrical data signal generator, wherein the at least one amplifier comprises a first amplifier and a second amplifier, wherein the at least one modulator comprises a first modulator and a second modulator, and wherein the optical data signal generator further comprises:

at least one phase shifter for phase shifting the radiation to one of the first modulator and the second modulator; and

a combiner for combining a first modulated signal from the first modulator and a second modulated signal from the second modulator to produce the optical data signal.

62. The system of claim 61, wherein the at least one phase shifter comprises a first phase shifter and a second phase shifter for phase shifting the radiation to the one of the first

modulator and the second modulator and phase shifting a combined signal out of the combiner, and wherein the optical data signal generator further comprises an attenuator for attenuating a signal out of the second phase shifter to produce the optical data signal.

63. The system of claim 47, wherein the means for matching comprises polarization maintaining optical fiber.

64. The system of claim 47, wherein the means for matching comprises a single crystal comprising the optical carrier signal generator and the optical data signal generator.

65. The system of claim 47, wherein the optical wave guide 60 comprises a long-haul optical fiber.

66. The system of claim 65, wherein the long-haul optical fiber comprises a single-mode optical fiber.

67. The system of claim 47, wherein the optical receiver converts the optical signal to an electrical signal, and wherein the phase lock operates on the electrical signal.

68. The system of claim 67, wherein the optical receiver comprises a photodetector.

69. The system of claim 67, further comprising a phase filter for filtering the electrical signal to compensate for dispersion.

70. The system of claim 69, wherein the phase filter comprises a plurality of broadside coupled lines.

71. The system of claim 69, wherein the phase filter compensates for dispersion from an optical wave guide, and wherein the phase filter comprises means for applying additional dispersion to the electrical signal having a group delay substantially opposite that of the optical wave guide.

72. The system of claim 67, wherein the phase lock comprises an IQ demodulator for separating the I component from the Q component.

73. The system of claim 72, wherein each of the I component and the Q component includes a Direct Current (DC) portion and a Radio Frequency (RF) portion, and wherein the phase lock further comprises a bias T element for each of the I component and the Q component to separate the DC portion from the RF portion.

74. The system of claim 73, wherein the phase lock further comprises a local oscillator for providing a reference signal to the IQ demodulator.

75. The system of claim 74, wherein the phase lock further comprises a reference signal generator for generating a reference signal for the local oscillator based on the DC portion of the I component and the DC portion of the Q component.

76. The system of claim 75, wherein the reference signal generator comprises a voltage controlled crystal oscillator.

77. The system of claim 76, wherein the reference signal generator further comprises a comparator for producing a signal representing a difference between the DC portion of the I component and the DC portion of the Q component.

78. The system of claim 77, wherein the reference signal generator further comprises an integrator with offset voltage control for zeroing the difference.

79. The system of claim 78, wherein the reference signal generator further comprises:

a frequency center control for providing a voltage to adjust a voltage out of the integrator; and

a combiner for combining the voltages from the frequency center control and the integrator.

80. The system of claim 76, wherein the reference signal generator further comprises a computing unit programmed to:

compare the DC portion of the I component and the DC portion of the Q component;

zero a difference between DC portion of the I component and the DC portion of the Q component; and

adjust a voltage output to be within a range needed for the voltage controlled crystal oscillator.

81. The system of claim 75, wherein the reference signal generator comprises a filter.

82. The system of claim 47, wherein the carrier signal comprises a single offset frequency.

83. The system of claim 82, wherein the single offset frequency comprises +30 GHz or –30GHz from a data band center.

84. The system of claim 82, wherein the single offset frequency comprises an integer multiple of half a bit rate for the optical signal.